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NATURE OF THE ANNOYANCE AND NOISE
ANNOYANCE RELATION AROUND AIRPORTS

Jacques Francois

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16. Abstract A description is given of an inquiry of 5,000 individuals around Orly Airport. The noise index used was the psophic index, indicating the intensity of the annoyance experienced by people living around the airport. The results of the survey indicate that sensitivity to noise is connected with certain personal factors.			
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NATURE OF THE ANNOYANCE AND NOISE ANNOYANCE
RELATION AROUND AIRPORTS

***** /70

Jacques Francois*

Abstract

The annoyance from aircraft noise depends upon many factors. A qualitative study has listed many reactions of the community: "shot" from low altitude flight, nervousness and fatigue from numerous flights, disturbance due to perturbations in speech, TV reception, unquietness pertaining to health hazards, economical damage, etc.

All these reactions are summarized in the term of "annoyance" and evaluated by direct questions, Guttman scales, or (as shown here) factorial analysis. The estimation of annoyance, integrating all aspects, is a function of many variables: pertaining to noise, of course, but also to the characteristics of people.

An inquiry over 5,000 people around Orly Airport was performed in order to study the correlation noise-annoyance. The noise-index was the so-called "indice psophique" I_e **** computed from the traffic characteristics. Curve of annoyance, as estimated by subjects, was compared with I_e curves, and a modification of the I_e was studied in order to improve the correlation.

In the same way, inquiries around Orly and Roissy-Charles de Gaulle Airport give an empirical justification of the night correction in the I_e computation.

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** Study financed by the STNA.

*** Enquiries financed by the Ministry of the Environment.

**** I_e is similar to the American NEF but using LPN Max (ed. note).

*****Numbers in margin indicate pagination of foreign text.

I. Nature and Measurement of Annoyance

The purpose of the "psophic index" is to predict the intensity of the annoyance experienced by people living around airports. More specifically, through the parameters which it takes into account and the weighting procedures used, this index seeks to represent the average customary annoyance. It postulates, in a way, that habitual annoyance, which is a summation of pinpoints of annoyance, is a clearly defined unidimensional continuous variable.

This concept of annoyance is no doubt schematic and rather abstract. Furthermore, the annoyance due to aircraft noise is a complex multifaceted phenomenon. To illustrate this, I will refer to a qualitative study of annoyance, carried out at the request of the STNA, and which is based on about 40 semi-leading interviews carried out around Orly. The object was to try and understand what annoyance means to someone who considers himself greatly annoyed by aircraft noise. The analysis of these interviews made it possible to describe a certain number of components of annoyance, showing that this concept involves closely linked elements of a very different nature. It may be considered schem- /71
atically that the aircraft noise causes unpleasant sensations, feelings of frustration, irritation because of the interruption of the communications and more deeply, the feeling of suffering aggressions which affect the lifestyle as well as the physical and mental health.

In the area of sensations, two different phenomena are observed, connected to two different types of noises.

--The residents most exposed to noise experience certain very violent noises, generally occasional, which cause traumatic sensations. The intensity of these noises and the vibrations which accompany them may cause a painful sensation, close to physical suffering, causing instinctive defensive gestures. The

sudden, brutal, "crushing" invasion of the noise of an aircraft passing at low altitude represents an aggression which may cause a shock momentarily, a trauma and more or less panic fear.

These dramatized aspects of the annoyance will be illustrated by some quotations from the interviews:

"It's internal, it shakes you up from your toes to your head, and it is very, very unpleasant! You are totally enveloped in this sort of vibration. You have the impression of being crushed, it's an infernal sensation. You put both hands on your ears, it's dreadful. It is difficult to say what you feel. I think that at a certain moment something happens and at that moment, it's abominable! It starts resounding, it's awful."

Woman, 42 years old, no profession; husband, teacher.

"There are times, after the plane passes, that it is easily one to two minutes before one can rest to know where one is. And I will tell you even something else which will surprise you very much: That you are totally bewildered and sometimes your nerves are so much on edge that you don't know what you are about, even while you are outwardly calm. You are there like idiots, you have got to ask again where you are because you are totally disoriented and you no longer know what you were saying, it tears at you so much, it tears you inside."

Man, 61 years old, factory watchman

"It is frightening, when you are thinking of something, when you are doing something very calm, and there is nothing to warn you that there is going to be such a noise. It's difficult to explain. For a few seconds you have the impression that the heart stops beating. I have the impression the house is collapsing,

and for just a tiny moment of time you have no idea at all where you are. You have the impression that everything is finished, that noise is going to dominate over everything; it's all over, there won't be anything afterwards, it would not be possible. You experience a kind of trembling and it does take a while to regain control of yourself, it's hard to react."

Woman, 37 years old, no profession, husband, TP mechanic

--Beside this type of disturbance, which generally remains of an exceptional nature, the annoyance mentioned most often by the persons living near Orly is the annoyance caused by the frequency of noisy flights. The high frequency of the flights is "irritating", "aggravating", "unnerving". Repetition of the noise causes a "nervous tension" producing a painful irritability and nervousness for an individual and, it is believed, affect interpersonal relations. In the aftermath of these sensations, the residents around the airports often mention a feeling of fatigue. They very rarely mention fatigue due to sleep disturbances since there is very little noise around Orly at night. Generally speaking, they refer to fatigue the sensation experienced at the end of the day after the passage of many aircraft. Some of them define this state as a "stunned state", "heavy-headedness".

"It is aggravating you know, the whole day long. When evening comes, your head is a little heavier. You say, "Oh God!, if only they would stop for a little while, an hour...!"

Woman, 58 years old, husband, mason foreman

"For me, noise means fatigue. From the mental point of view, it's demoralizing, you know, it destroys you when you hear noise continuously."

Woman, 49 years old, husband, coachbuilder

"It's something that goes on too long at a time, which is unpleasant. You become tense, you know, by the end of the day,

when it goes on too long."

Woman, 35 years old, husband, sales representative

These feelings of irritation, tiredness are greatly reinforced by interruptions, holdups, which represent in some way violations of individual freedom and a deterioration of the lifestyle. The most direct, most characteristic and most frequently cited effect of noise is the interruption of communications. Noise disturbs conversations, which is particularly irritating; the unforeseen intrusion of noise forces you to speak louder or to stop, forces you to repeat. Interruptions prevent you from "keeping up a conversation", from "speaking seriously". You are worried about the effect on education and school work. Furthermore, noise disturbs your enjoyment of TV, radio, record player. The irritation caused is very great because it is combined with a feeling of frustration.

In the most highly exposed areas, the highly annoyed person cannot escape from the noise. Thus the aircraft endangers the very image of the home which is, traditionally the refuge, the shelter, the private area where one could be alone and away from the outside world. The person living near an airport cannot protect himself effectively against the intrusion of noise and the vibrations make him feel that his home is penetrated through and through by the noise. The home is thus no longer anything but an illusory, fragile protection. The individual who considers himself vulnerable to noise, is so to say, naked and directly exposed to noise. This reinforces the impression of suffering an aggression and the feeling of insecurity.

If the home still satisfies its psychological function of protection, it is really a refuge with respect to the outside, but the person has the painful impression that he must shut himself inside to be isolated from noise. He is a prisoner in his own home, and he must surround himself with precautions (shut the

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windows), preventing him from leading the "normal", "relaxed" life to which he feels he is entitled. This annoyance increases in the summer months when other frustrations are added: noise prevents you from enjoying the fresh air and nature. This is a great frustration for suburban people who would like to take advantage often of the joys of the countryside, the charms of a stroll, or more simply, to relax in their garden.

Another important dimension of the annoyance is due to the threats the person living near the airport feels because of the air traffic. You fear the aircraft accident in a more or less latent or episodic manner because of the takeoff of an aircraft which seems to be too heavy and does not seem to rise quickly enough or at the time of landing for which the intensity of the noise rises in a too rapid crescendo. More insidiously, with regard to the two above-mentioned types of sensations, the noise seems to be a threat to the physical and mental health of the people living near airports. Those interviewed often feared that noise would cause disorders of the temperament, fits of hysterics, nervous depressions, cardiac disorders, an aggravation in the condition of patients. Precise cases are mentioned in the neighborhood of disorders imputed to noise, or they mention their doctor's opinion and they express concern for people who seem most vulnerable: children, old people. A person living near an airport, disturbed by noise in his daily life feels on him and on his near and dear ones the weight of a more or less long term threat: the abnormal conditions in his life must necessarily lead to disastrous consequences. The "so-called" home cannot mask a slow but inexorable deterioration of the "nervous balance", whose effects will become perceptible some day.

Air pollution also represents an annoyance caused by air traffic. The residents near the airport who are greatly disturbed by the aircraft noise mention it more often than the others. The smokes that they see, the odors they smell and the oily film which

covers many things make them aware of environmental pollution. The latter is a nuisance because it dirties things (window panes, clotheslines, the windshields...), it degrades nature, the garden, it is a source of worry as regards health.

On the whole, the deterioration of the lifestyle goes hand in hand with the feeling of suffering economic losses, among people who occasionally consider themselves as "disaster victims". The homeowner believes it will be difficult to find a buyer for his home and he would have to sell it for under its real value; he may thus feel "trapped", forced to remain where he is.

It is this group of complex phenomena which we are attempting to translate into a single variable, annoyance, which will be achieved with a questionnaire. To measure this resulting variable, the researchers resorted to two methods:

--The direct question of the type: "Are you highly, rather, slightly or not at all, annoyed by the noise of aircraft?" The great advantage of this method is that the residents near the airports accomplish themselves the synthesis of all that they experience and which is placed on a scale. Furthermore, it avoids the theoretical problems posed by this variable since it is thus sufficient to consider as "highly annoyed", the person who says so. Nevertheless, it has certain drawbacks, in particular, it permits the distinction of only a very small number of different annoyance levels.

--To make it possible to establish a more finely modulated variable, an attempt was made to take into account the answers to a series of questions which consider the intensity of the annoyance, as well as its frequency, its forms (annoyance for TV watching, conversations, do the windows have to be closed?, does it wake you up?). To synthesize the answers in a single indicator, we resort to Guttman's hierarchic analysis, an

implication model which permits the establishment of annoyance scales. Subsequently, we used factorial analysis in main components, making it possible to derive a general underlying factor which takes into account the connections between the answers to the different questions. The advantage of the last method is to reach a continuous variable and to integrate the different facets of annoyance. We used it in studies conducted around Orly and Roissy, since it is of great operational interest because it makes it possible to differentiate at the individual level, many annoyance levels.

Nowadays, after the studies of Langdon and McKennell, the trend is to revert to the first method (direct questioning on the intensity of the annoyance) especially because of the above mentioned advantages.

Actually, either of the methods permit us to obtain from all the complex phenomena which we have just described, annoyance indicators which are reliable enough to allow on the basis of these indicators, a critical analysis of the noise indicators.

II. Noise-annoyance indicators

The calculation programs for an indicator such as the "psophic" indicator used around airports attempt both to consider the maximum number of factors to increase the quality of the prediction of annoyance and to make simplifying hypotheses so as not to burden unnecessarily the calculation of the indicator. A certain number of empirical hypotheses had to be put forward on the role and weighting of the different factors, which could not all be justified experimentally. Some of them are based even more on simple "common sense" than on well established theoretical justifications. In the work of adjustment and improvement of the "psophic indicator", the enquiries by polling may provide a useful contribution to acoustics experts. The study of the

relation between the noise indicator and the annoyance level permits indeed questions on the indicator, the analysis of its validity and significance, including that at the level of details, at the level of any of the hypotheses on which the calculation of the indicator is based.

As an example, I would like to mention the studies conducted by the IFOP on the request of the DGAC (General Civil Aviation Board), whose results were analyzed in close collaboration of the STNA Nuisance Division.

In April-May, 1971, we conducted an enquiry with a sample of about 5000 residents near Orly, 20 years old or more. The purpose of this study was the overall analysis of the connection between noise and annoyance, but also the finer examination of the local variations of these variables to detect possible anomalies. A rather extensive enquiry area was defined to permit large variations of exposure to noise (Figure 1). This area is contained within a rectangle of which the longer side is in the east-west direction, about 25 km long by 15 km wide. The airport is located in the north of this area. This survey area was divided into squares of smaller dimensions in such a manner that it could be considered that the conditions of exposure to noise were homogeneous inside each square. The studied sector was divided on the basis of 9 squares per km^2 (i.e., squares of 333 m side).

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We then had to measure the annoyance level in each square. Because of the high interindividual variability of the annoyance, we could not be satisfied with knowing the annoyance for a single individual inside each square: We had to be able to define average annoyance levels at each point of the studied territory. Thus, we were led to conducting five interviews in each inhabited square, that is, 45 interviews per km^2 . Altogether, about 5,000 persons were interviewed in about 1000 squares.

The questions on the annoyance caused by aircraft noise were processed by a factor analysis in main components. Starting from the first factor obtained, we established an annoyance indicator which by convention has 50 as its average and 15 as standard deviation. We then calculated the annoyance level for each of the 5,000 persons interviewed and the average value of this annoyance indicator in each square (average of five individual figures) to be able finally to establish a chart of the annoyance around Orly (Figure 2).

For their part, the technical services of the SGAC (Civil Aviation General Services) calculated the value of the "psophic indicator" at the center of the 1000 squares on the basis of the air traffic of 1971, the year of the survey, and established the chart of the isopsophic curves around Orly.

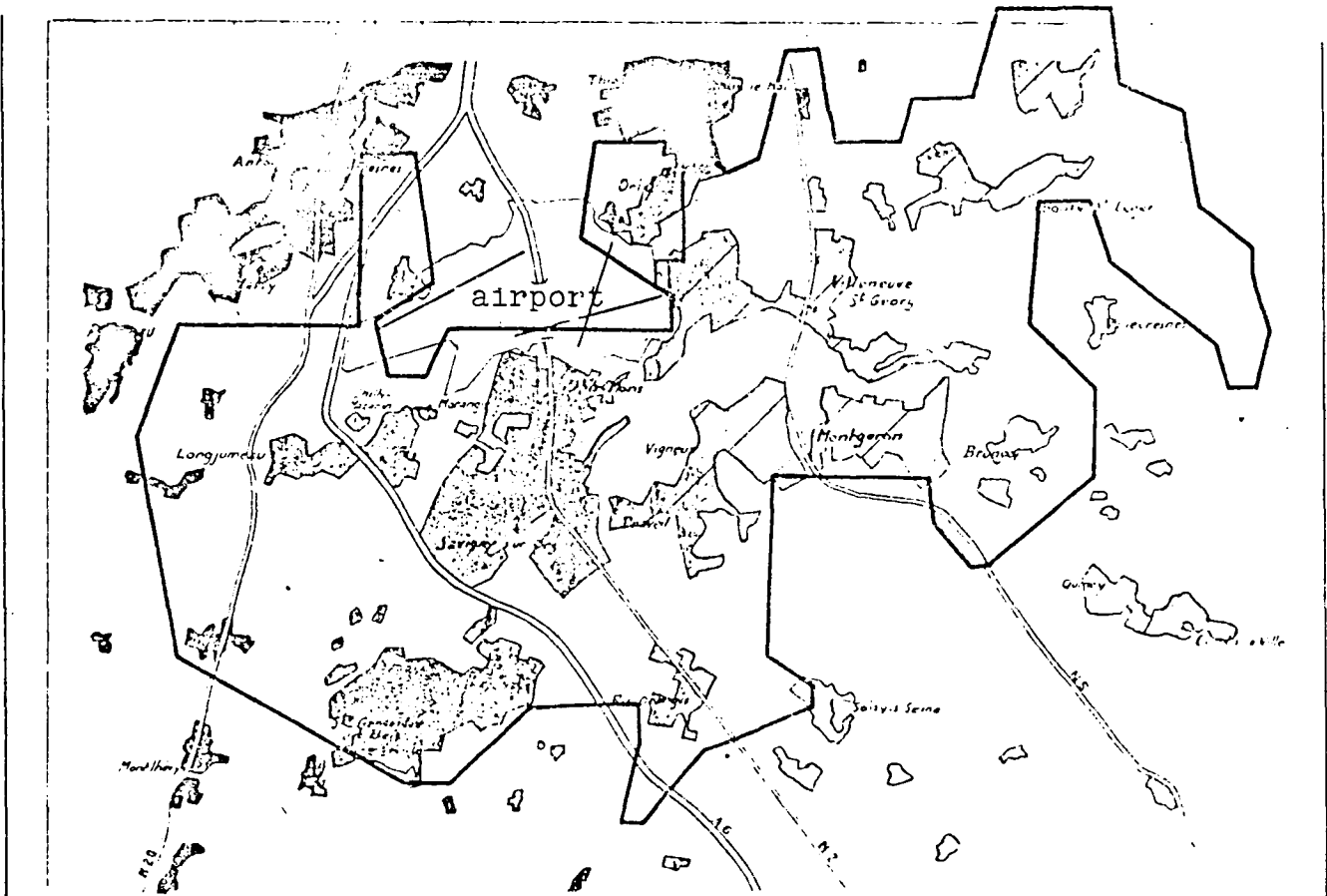


Figure 1. Area of survey

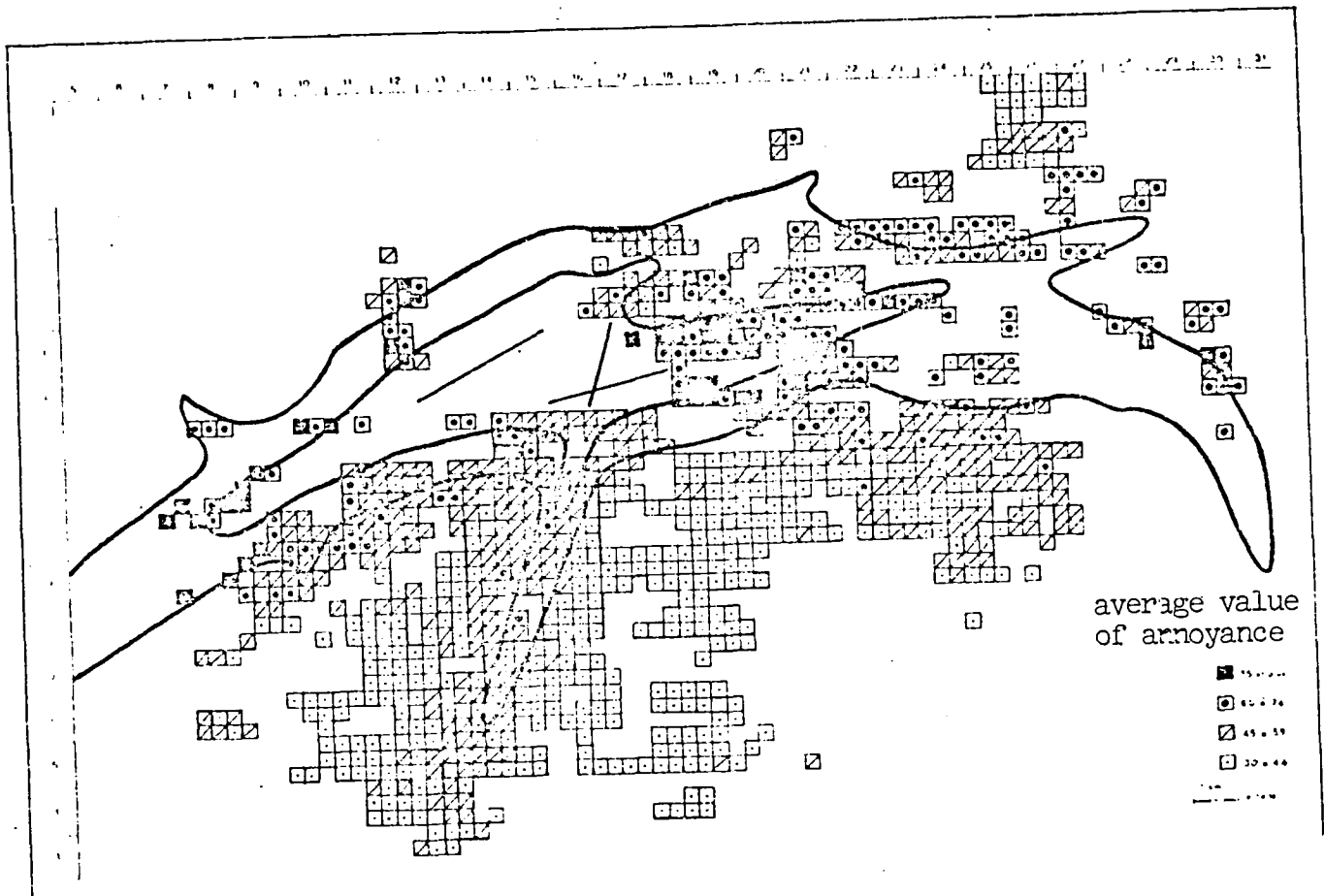


Figure 2. Paris-Orly Airport. Map of annoyance. Isopsophic curves for the indicators 96 and 84.

The comparison of the map showing annoyance and the system of isopsophic curves shows a fairly great consistency between these two indicators. The annoyance indicator is sensitive enough, reveals clearly the axes of the east-west and north-south directions; annoyance decreases as we draw away from the trajectories. It may be noted that occasionally considerable differences can be observed between adjacent squares which are no doubt to be imputed to "parasite" factors; local peculiarities in the exposure or result of the interindividual variability (which would have been "erased" if the number of interviews in each square had been greater).

curves for indices: 96.1

89.1

84.1

scale $\frac{1}{10}$ km

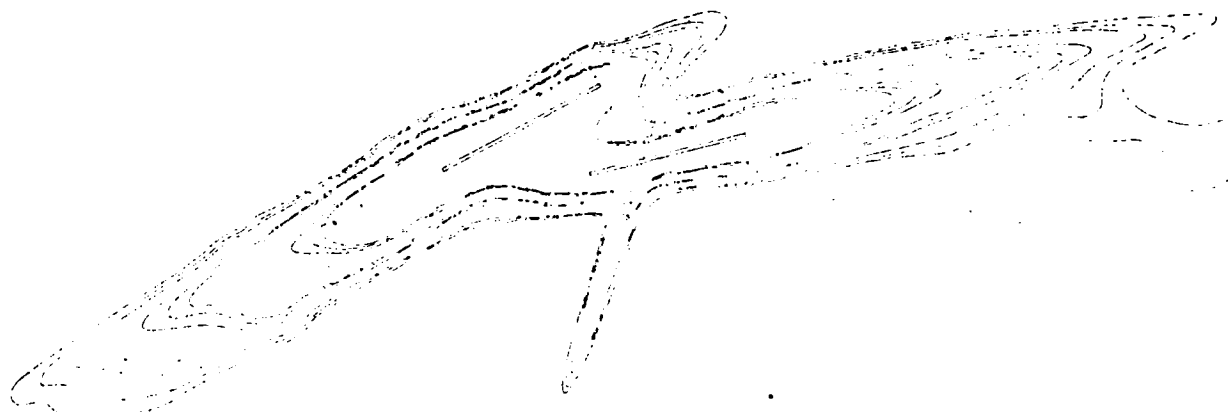


Figure 3. Paris Orly Airport. Isopsophic curves established by the new method (basis 1971 traffic)

On the whole, the correlation coefficient (calculated taking as statistical unit the average value of annoyance in each square and the value of the "psophic indicator" at the center of each square) is 60. Apart from these results, satisfactory on the whole, the examination of the map reveals two anomalies:

--For an equal "psophic indicator" annoyance is less in the north-south direction than for the east-west one. The former has a very low annual average traffic (of the order of 35 movements per day in 1971) and very unequally distributed over the year. The study of the answers of the residents exposed to the north-south traffic shows that they reduce the intensity of the noise heard: for the same noise, less of them will rate it as very loud as compared with the residents of the east-west direction. At the same time, they also reduce their average annoyance. On the other hand, the correlation between the "psophic indicator" is a little

less satisfactory in the north-south direction ($r = .57$) than in the east-west one ($r = .64$). These results raise the problem of taking into consideration when calculating the indicator the relative use of the runways, which, in the present case, leads to overestimating the annoyance of the residents living close to the less frequently used runway;

--in the north-east sector, on the other hand, the annoyance seems to be underestimated by the index. It was possible to draw the conclusion that the annoyance levels and the values of the psophic indicator would be more consistent with what is observed in the other sectors exposed in the east-west traffic if the calculation of the indicator took into account the spread of the trajectories around the theoretical trajectories and if we penalized the landing noises (which represent about 75% of the noises heard in the north-east sector).

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Because of its procedure which led to the establishment of a map of the annoyance, the survey by poll made it possible to evaluate the quality of the program of the calculation of the psophic indicator and to formulate constructive criticisms.

It was possible to reuse the data collected in this survey, a few years later, to judge the benefit of the modifications introduced in the program of calculation of the psophic indicator.

After 1971, various modifications of the program of calculation of the psophic indicator on the basis of the traffic data were proposed for the purpose of improving it, to permit a better prediction of the annoyance suffered by the residents near airports: Modification to take into account the nocturnal movements, modifications in the use of runway use coefficients, taking into account ground effects and effects of masks, of spreads of the trajectories.

Altogether, we arrive at a rather different system of isopsophic curves and the narrowing of the curves (Figure 3). The comparison of the new values of the psophic indicator and the annoyance levels permits the analysis of the benefit derived from these modifications. For the mathematical evaluation, the survey region was divided into large sectors, in each of which we calculated the correlation between the annoyance and the psophic indicator established according to both the methods (Figure 4).

The coefficients obtained suggest the formulation of several remarks:

a. in each sector, the evolution took place in the positive direction. This systematic improvement may be attributed, at least partly, to taking into account the spread of the trajectories around the theoretical trajectories;

b. the correlation is less satisfactory in the north-south sector. Now the calculation of the correlation assumes that it is possible to put forward the hypothesis of a regression straight line. The variation of the average annoyance values as a function of the psophic indicator (Figure 5) shows that we may legitimately consider that the points are aligned on a straight line for the east-west direction. On the other hand, this is not the case for the north-south direction, which explains the poorer correlation. It seems that the hypothesis of a straight line can be applied only when the psophic indicator is less than 80. Beyond this value, the reduction of the annoyance suffered by residents near airports makes the validity of the psophic indicator unreliable in this sector;

c. the correlation coefficient for the entire survey area rose from .60 to .69. This improvement derives from the better use of the runway use coefficient which made it possible to increase the coherence of the prediction of the annoyance in both the axes of the runway. These phenomena may be visualized by

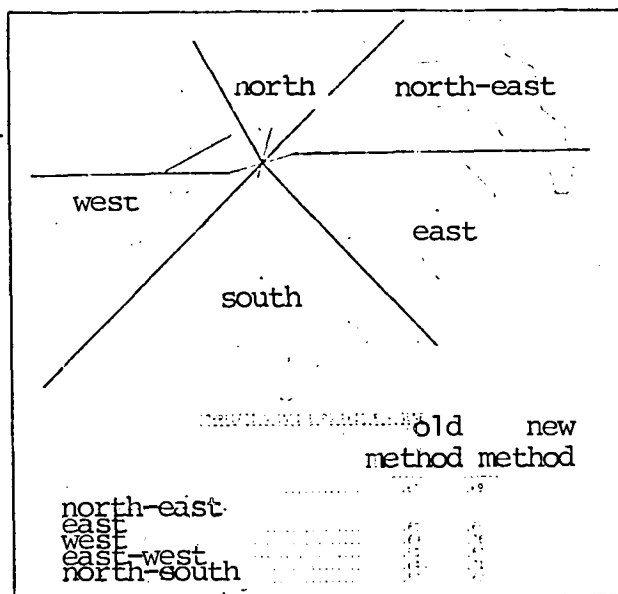


Figure 4. Sectors of the survey area distinguished in the area of the results.

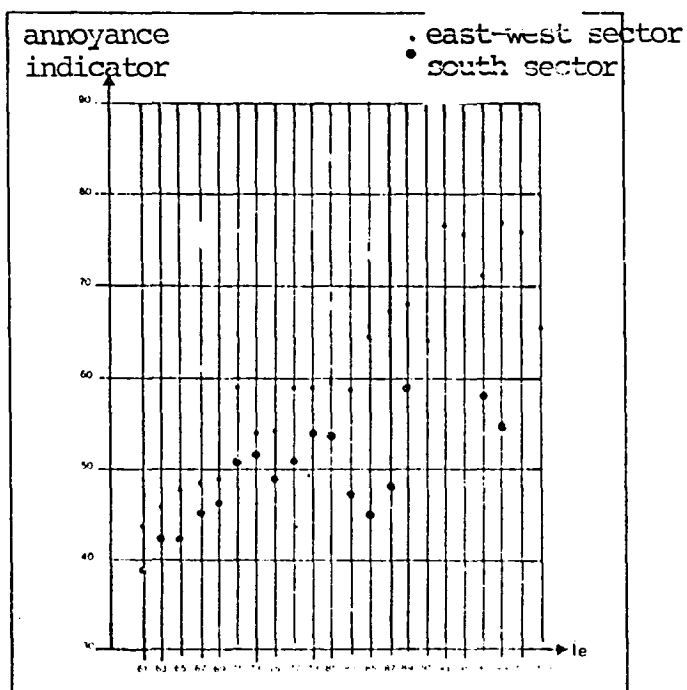


Figure 5. Average of the annoyance indicator according to the exposure indicator I_e (calculated by the new method).

calculating the regression straight lines for the two psophic indicators (Figure 6). With the new method of calculating the latter, the straight line representing the east-west sector underwent a translation, but its slope remained identical; on the other hand, the slope of the straight line of the north-south sector became more marked and this straight line comes closer to the straight line representing the east-west sector. A single straight line provides, therefore, a better summary of all the points of the annoyance-psophic indicator diagram, causing improvement in the correlation.

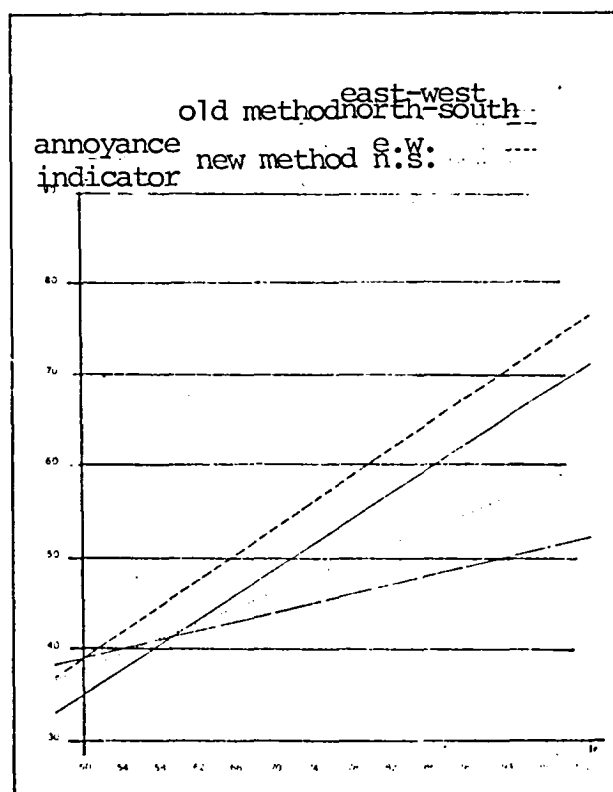


Figure 6. Regression straight lines.

Meanwhile, it will be observed that the translation of the east-west straight line and the increase of the slope of the north-south straight line show the narrowing of the isopsophic curve which had been referred to earlier: for a same indicator value, the average annoyance level is higher than for the psophic

index calculated by the old method.

On the whole, on the basis of the data of the 1971 survey, it was possible to verify that the modifications introduced in the program of calculation of the psophic indicator really bring /76 about an improvement in the prediction of the annoyance. But the indicator continues to overestimate the annoyance of the people living near the north-south runway, at least for high values of the indicator.

Other surveys based on different procedures permitted us to contribute further to the study of the validity of the hypotheses included in the calculation of the psophic indicator.

In 1975, the IFOP questioned about 500 people living near Roissy and 1000 near Orly. The purpose of these surveys, financed by the Ministry of the Environment, was to study the repercussions of the noise of aircraft on the mental stability of persons living near the airports. On the request of STNA, we studied again the data of the two surveys to examine the problem of taking into consideration the nocturnal movements.

We know that the psophic indicator penalizes considerably each nocturnal flight by the application of the coefficient 10, that is, an aircraft movement between 10 p.m. and 6 a.m. is counted as 10 movements. At night the number of movements is similar for both airports (about 20). When the night flights are weighted by 10, the night flight component becomes high: 35% in Orly, 42% in Roissy (in 1975, the year of the survey).

In the survey conducted around these two airports, we had asked the residents to indicate generally at what times they were disturbed by the noise, proposing a series of approximate intervals of time* (page 17). This question allows us to know the variation of the annoyance over 24 hours (Figure 7). The graph

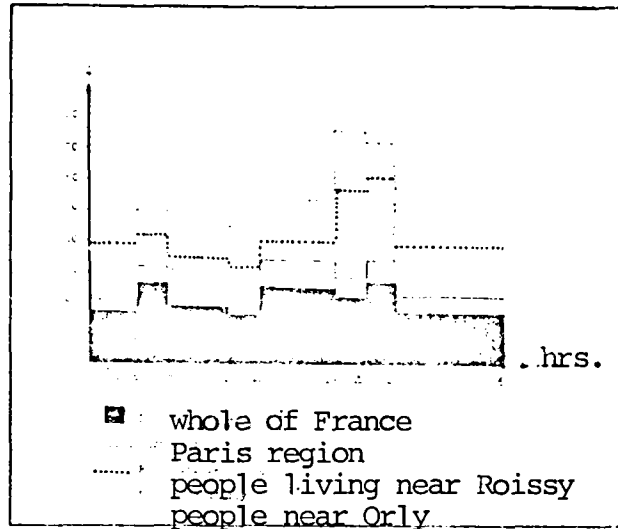


Figure 7. Proportions of persons who say they are annoyed in each time interval.

also contains the results of this same question asked of a national sampling of 1000 persons and the answers of about 170 residents of the Parisian center extracted from this sampling. It is thus possible to estimate the "additional" annoyance caused by air traffic. This graph shows that if the additional annoyance is particularly high in the interval 7 p.m. to 11 p.m., during the night (11 p.m. to 6 a.m.) it is nil in Orly, whereas it remains high around Roissy.

On the next graph (Figure 8) we indicated the proportion of people near the airport disturbed by the noise and the average

*The question was formulated in the following manner:

Normally at what times of the day do you hear noises which annoy you?

- early morning (6 a.m. to 8 a.m.)
- during the morning (8 a.m. to 12 noon)
- at lunchtime (noon to 2 p.m.)
- in the afternoon (2 p.m. to 7 p.m.)
- at dinner time (7 p.m. to 9 p.m.)
- in the evening (9 p.m. to 11 p.m.)
- at night (11 p.m. to 6 a.m.)
- at no time

hourly number of movements per period considered. A parallel course of the two curves would tend to prove that sensitivity to noise remains constant over 24 hours. Now significant shifts are observed which may be interpreted in the following manner:

--from 6 a.m. to 8 a.m., a relatively high proportion is annoyed by the noise, both in Roissy and in Orly. It appears that, at least at the beginning of this period, many of the residents are not yet up. The flights occurring in the early morning would cause an annoyance which the psophic indicator may underestimate to the extent that the penalization of night flights no longer applies starting at 6 a.m.

--From 8 a.m. to 7 p.m., the average hourly number of movements varies little both in Roissy and in Orly. The slight traffic fluctuations and of the number of persons annoyed are not parallel and seem to indicate that the tolerance to morning flights is better than for those of the afternoon.

--In the early evening (from 7 p.m. to 9 p.m.) the shift between the curves is close to what was observed for the afternoon, and the proportion of the residents near airports annoyed by the noise corresponds very clearly to the large number of movements.

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--For the period extending from 9 p.m. to 11 p.m., account should be taken of the fact that penalization of the air traffic starts at 10 p.m.; the average number of movements, taken into account by the psophic indicator, is multiplied by 10 during the second hour. As compared with the interval of 7 p.m. to 9 p.m., the weighted number of movements increases, whereas the real number decreases. For the two airports, the absence of weighting would not correspond at all to the high percentage of persons annoyed between 9 p.m. and 11 p.m. But in Roissy, and even more clearly, in Orly, the weighting seems excessive, or at least too brutal: the model by which one flight = 1 flight from 9 p.m. to

10 p.m. and one flight = 10 flights from 10 p.m. to 11 p.m., adapts poorly to reality. It may be estimated that though penalization of night flights is justified, the weighting should be progressive instead of being applied suddenly at a maximum rate.

--From 11 p.m. to 6 a.m., the results obtained do not allow any doubts about weighting of night flights. In Roissy, the proportion of residents annoyed at night is much more consistent with the average number of weighted movements than unweighted ones.

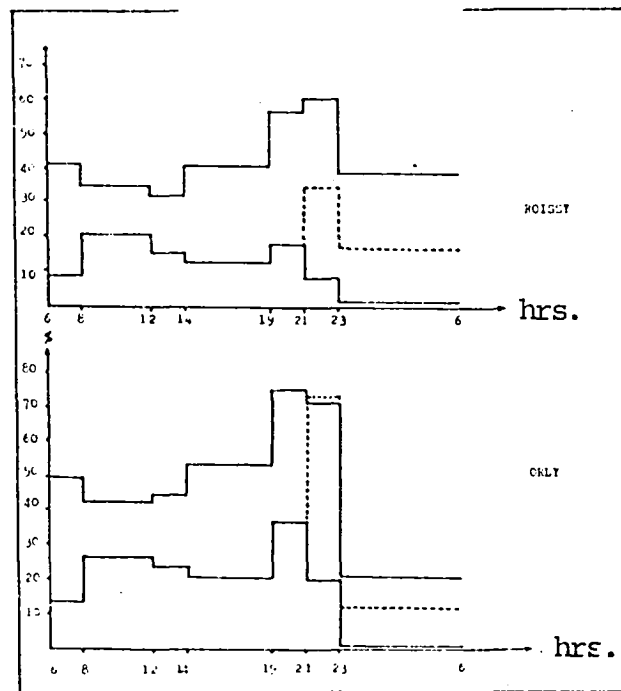


Figure 8. Upper curve: Proportion of residents annoyed by the noise
 Lower curve: Average hourly number of movements per interval considered
 —without nocturnal weighting
with weighting by 10 at night (10 p.m. to 6 a.m.)

In Orly the number of persons annoyed seems low as compared with the number of weighted movements. But these movements are those of aircraft causing low noise, the jet plane traffic being concentrated in the evening (whereas at Roissy the night traffic

involves aircraft of the same type as daytime traffic). Since the nature of the traffic is not the same, the average number of movements at night is not a good noise indicator for Orly.

Therefore, to pursue the analysis we must refer not to the number of movements, but to the psophic indicator. We have not enough place here to describe this analysis in detail, and will content ourselves with indicating that from 11 p.m. to 6 a.m., the weighting of the movements by 10 seems to have achieved its goal: It makes it possible to foresee the number of persons annoyed with satisfactory coherence for the two airports, characterized by very different night traffics.

These different examples show that the criterion of annoyance is of an operational nature which may offer valuable data to acoustic specialists. In spite of the want of theoretical background for the annoyance concept, in spite of the complexity of this concept and the rather "rough" method used to grasp this variable, taking into account annoyance in surveys by polling makes it possible to confirm the work of acoustics specialists, to justify or to refute some hypothesis or the other. It may also reveal unexpected "anomalies", thus inciting constructive reflections.

If, besides the acoustics experts, we think of the public authorities, the officials assigned to making decisions in the area of environment, this type of research contributes to improving the means of acquiring knowledge, justifying the tools used in making decisions, clarifying the criteria on which the decision is based. For example, the analysis of the noise-annoyance relation may make one question the legitimacy of the regulations based on the A, B, C regions around the airport, the meaning of these regions in terms of annoyance.

Moreover, it is important to comprehend globally all the facets of annoyance, all the effects of noise. In particular, we must examine the role of the individual characteristics in the noise-annoyance relation. In conclusion, I will say a few words about the results of an investigation conducted in this area.

In the already mentioned survey, conducted by the IFOP in 1975 of about 1000 residents around Orly, the persons interviewed were asked to answer a questionnaire on health evaluation and to undergo two personality tests. Each resident was classified by the value of the psophic indicator of the area of his residence calculated by the Paris Airport on the basis of the traffic of the year of the survey) and by the annoyance level (obtained by factor analysis). We calculated for all the persons interviewed the spread between their annoyance level and the average level of annoyance of the persons whose home is characterized by the same value of the psophic index. According to this new variable, the sampling was divided into three groups: hyposensitive persons, persons of average sensitivity and persons hypersensitive to noise.

The breakdown of the answers of these three groups reveals significant variations confirming that sensitivity to noise is connected with certain personal factors (Figure 9). But it should be noted that the individual characteristics taken into consideration permit a better understanding of hypersensitivity to noise than hyposensitivity. In other words, while these results allow a partial explanation of noise intolerance, a tolerance higher than average remains a more enigmatic phenomenon.

As regards the relation between noise and individual characteristics, it poses the problem of the effects of noise on health. Certain results obtained on people who have lived at least 10 years around Orly seem to show that the relatively long

SENSITIVITY TO NOISE AND PERSONAL CHARACTERISTICS

Sampling: Persons living near Orly between the ages of 20 and 65

	<u>hyposen-</u> <u>sitivity</u>	<u>average</u> <u>sensitivity</u>	<u>hypersen-</u> <u>sitivity</u>
total number	194	525	277
average anxiety level (MAS)	16.9	16.2	19.1
	%	%	%
during the past 12 months, their health was good	57	59	43
claim to have had a chronic disease	15	19	29
suffer pains in some part of the body	30	39	42
are particularly tired	31	27	40
exhausted by their work	20	18	29
have fits of dizziness and giddiness	14	13	19
suffer from headaches	17	18	24
in the last 7 days:			
have taken aspirin	23	20	26
have taken other drugs	32	28	38

Figure 9

exposure to a high level of ambient noise affects the state of their health or at least, the evaluation made by the residents themselves (Figure 10). One can, therefore, not reject the hypothesis of a harmful effect of noise on the health. Beside the noise-annoyance relation, which relates to psychological concepts, one should no doubt ask oneself about the noise-health relation (of which one of the aspects, which was not studied here since we were examining the case of Orly, may be the occurrence of disturbances of sleep caused by night traffic).

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NOISE LEVEL AND PERSONAL CHARACTERISTICS

Sampling: persons between the ages of 20 and 65 living for more than 10 years around Orly

	<u>psophic indicator</u>			
	<u>less than</u> <u>89</u>	<u>89-92</u>	<u>93-96</u>	<u>over</u> <u>97</u>
total number	120	135	102	154
	%	%	%	%
good health during the last 12 months	69	51	54	38
suffered pain in some part of the body	38	40	37	49
feel especially tired	25	28	38	35
have fits of giddiness and dizziness	12	19	18	18
suffer from headaches	16	23	21	21

Figure 10

REFERENCES

The results described in this paper are those of studies conducted by Jacques Francois (IFOP) on behalf of the STNA (Civil Aviation) and the Noise and Vibration Committee (Ministry of the Environment).

The complete reports of these studies bear the following titles;

Studies financed by the STNA:

- Annoyance caused by the noise of aircraft near the Orly Airport and reactions of nearby residents. Quantitative Study. August 1972.
- Connection between noise and annoyance around Orly. January 1973.
- Connection between noise and annoyance around Orly. Synthesis, March 1974.
- Introduction of modifications in the method of calculating the "psophic indicator". November 1975.
- Consideration of Nocturnal annoyance in the calculation of the "psophic indicator". February 1977.

Studies financed by the Noise and Vibrations Committee:

- Repercussions of aircraft noise on the mental stability of

residents around airports. Investigation conducted around Roissy and Orly. September 1975.

- Repercussions of aircraft noise on the mental stability of residents around airports. Supplementary analyses of the survey conducted around Orly. August 1977.

